

Work Organization Practices for Lean Production: A Study in Spanish and Brazilian Manufacturers

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Abstract

This work aims to discuss particular work organization practices in human resources reported as successful by companies adopting lean production principles, and investigate them through real examples observed on manufacturing plants in Spain and Brazil. A set of work organization practices was previously established by one of the authors, through interviews with practitioners of lean production and review of the literature. A series of visits and informal interviews at Spanish and Brazilian automotive parts manufacturers that follow lean production were conducted to verify that the set of policies are indeed practiced. Examples obtained from these visits and interviews are presented for each practice. This working paper was written by undergraduate student Victor Rentes, with the guidance of Professor Dr. Jordi Olivella. A comparative study between the practices observed in the two different countries is not present here. It is a possible topic for future research.

Keywords: Lean production, work organization, work teams, Spain, Brazil, automotive industry

1. Introduction

Lean production has been mostly spread by the publications of Monden (1983), Ohno (1988) and Womack et al., (1990), and it is based on the Toyota Production System (TPS). The implementation of TPS began soon after World War II, but it did not begin to attract the attention of the Japanese industry until the first oil crisis in the fall of 1973 (Ohno, 1988).

Today, many businesses use lean principles, practices, and tools to effectively create customer value—goods and services with higher quality and fewer defects—with less human effort, less space, less capital, and less time than the traditional system of mass production. At its core, lean production is focused on eliminating waste (called *muda* in Japanese).

Work organization practices in companies that adopt lean principles must be, tailored to local labor laws, culture and collective agreements (Olivella, 2008). However, some work organization practices are reported worldwide by the literature as successful in organizations implementing lean production, regardless of country or industry.

Based on review of the literature and interview with experienced practitioners and consultants on lean production, in previous work by one of the authors, a set of work practices was established. They are: ‘Standardisation, discipline and control’, that aim to obtain the uniformity of the work; ‘Continuous training and learning’; ‘Team-based organization’, i.e., an organization where work is assigned to and done by teams; ‘Participation and empowerment’, defined by the fact that the functions assumed by direct workers are more extended; ‘Multiskilling and adaptability’; ‘Common values’ and ‘Compensation and rewards to support lean production’. The objectives selected represent the main successful organizational practices referred to in the literature (Olivella, 2008). These work practices are referred to in main books on lean production as shown in Table 1.

Table 1. Literature overview of work organization objectives for lean production

Objectives	Monden (1983)	Ohno (1988)	Shingo and Dillon (1989)	Suzaki (1993)	Womack and Jones (1996)	Liker (2004)
Standardization, discipline and control	Yes	Yes	Yes	Yes	Yes	Yes
Continuous training and learning	-	(1)	-	Yes	(2)	Yes
Team-based organization	-	Yes	-	Yes	Yes	Yes
Participation and empowerment	(3)	(4)	(5)	Yes	Yes	Yes
Multiskilling and adaptability	Yes	Yes	-	Yes	Yes	Yes
Common values	-	-	-	Yes	Yes	Yes
Compensation and rewards to support Lean Production	(6)	-	-	(7)	Yes	(8)
(1) cited indirectly; (2) especially training in lean methods; (3) participation in improvement activities and quality control; (4) participation in establishing standards; (5) includes Poka-Yoke, which implies empowered functions; (6) rewards for best ideas; (7) modest monetary rewards; (8) only cited in examples.						

2. Classification

Standardization, Discipline and Control

According to Spear S. and Bowen, H.K. (1999), the first rule governing what they call Toyota Production System’s DNA is that all work shall be highly specified as to content, sequence, timing and outcome. That means having a standard documented procedure for every operation, so that nothing becomes ambiguous. By standardizing, a company may acquire many competitive advantages.

According to Ohno (1988), standardization of operational procedure is essential for promoting job rotation. As every worker performs each operation according to standards, performance does not vary from worker to worker, so results are stable and predictable.

Standardized work procedures should be used towards improvement. Since it becomes immediately apparent when problems occur at any given operation on the shop floor, when utilizing standards, worker and supervisor can solve them on the spot and change the standard procedure if necessary, for future execution (Spear S. and Bowen, H.K., 1999). Without standards, improvement potential is very limited (Suzaki, 1987).

Another clear benefit is that standardization makes training much easier, as people can learn new jobs with ease using documented standard procedures (Suzaki, 1987). That reduces training time for new and existing workers, allowing the organization to have multiskilled workforce, and relocate it with more flexibility in accordance to demand.

However, for a line worker to be able to write a standard work sheet that others can understand, he or she must be convinced of its importance (Ohno, 1988). Line workers must participate in the standardizing process to assure the best possible method is captured on each standard procedure.

A company's competitive advantage is tied to the degree to which each participant pays attention to practicing standards. Progressive organizations tend to practice good discipline in following standards (Suzaki, 1987). However, to Spear S. and Bowen H.K., (1999), the fact that the scientific method is so ingrained at Toyota explains why the high degree of specification and structure at the company does not promote the command and control environment one might expect. The system actually stimulates workers and managers to engage in the kind of experimentation that is widely recognized as the cornerstone of a learning organization.

Continuous Training and Learning

From the organization's point of view, whether or not its people are learning new skills effectively will impact its course in business (Suzaki, 1993). In lean production, line workers must have a high degree of influence, and together form a great body of knowledge (Olivella, 2008). When workers, supervisors or specialized workers are recruited, for instance, willingness to learn new skills is highly valued in organizations practicing the lean principles. The inclusion of interpersonal skills training is also valued. Workers, supervisor and technicians need to be constantly deepening their quality-control knowledge, lean concepts knowledge and general vision of the processes.

Spear S. and Bowen, H.K. (1999) also analyzed the Toyota learning mechanism. They argued that both personal and organizational learning are obtained by permanently questioning the appropriateness of methods through rigorous use of the scientific method. Managers are expected to teach their workers how to solve problems according to the scientific method. According to the authors, companies managed under the Toyota Production System usually share an overarching belief that people are the most significant corporate asset, and that investments in their knowledge and skills are necessary to build competitiveness.

Team-based Organizations

Work teams are at the heart of a lean production factory (Womack et al., 1990). In manufacturing, teamwork is essential (Ohno, 1988). Teamwork refers to joint, shared work. In companies, teamwork can occur at various levels and intensities (Olivella, 2008). A worker can be a member of different groups simultaneously. Prominent examples of team-based work are autonomous cells. For Hyer and Brown (1999), cellular manufacturing is more than a layout: it is work connected in time, space and information.

According to Suzaki (1993), team leaders must understand the improvement process at the shop floor and be able to provide guidance whatever the situation is. Supervisors and team leaders should encourage workers to cooperate with each other, and to constantly improve their work methods. Activities should be organized to improve team cohesion, and work spaces should be common for team members, as well as personalized by the team with important information displayed, such as production planned and executed, incidents, quality level, pictures, rewards, rotation schedule, vacation schedule, etc.

The number of workers per team is determined by the types of problems expected to occur, the levels of assistance the team members need, and the skills and capabilities of the team leader (Spear S. and Bowen, H.K., 1999).

Ohno (1988) compares teamwork in manufacturing to track relay. Parts should be handed over as if they were batons. If the baton is passed well, the total final time can be better than the individual times of the four runners. A strong runner can make up for a weak runner. If an operator in a later process is delayed, others should help set his or her machine. Although in work or sports it is desirable for team members to work with equal strengths, in actuality this is not always the case, particularly with new employees who are unfamiliar with the work. Powerful teamwork is needed.

Participation and Empowerment

Isa and Tsuru (2002) found decentralization to be the most widespread practice among a group of Japanese producers implementing lean. Beyond simple consultation, workers need to have real influence and power in decision making. Suzaki (1987) states that when there is direct involvement of many people a much larger pool of organizational ability is created, as opposed to when skills and knowledge are centrally controlled.

Companies where a high percentage of workers are assigned more extended responsibilities, such as quality control, maintenance, work planning and safety responsibilities have an advantage by freeing more time for supervisors and managers to take on more important responsibilities. Workers should be provided detailed information on quality, performance, accidents, etc. as feedback, so they can properly manage these activities.

Suggestion systems are effective to promote participation throughout the company, as it will be discussed later in this article. Apart from suggestion systems, improvement groups are also well commented. They were first known around the world as 'quality circles' (Shingo and Dillon, 1989), and their members can hail from different teams or different areas of the company (Monden, 1983). These groups may also be known as "kaizen groups", whereas meetings to analyze a particular issue with an ad hoc group of participants are known as "kaizen workshops" (Liker, 2004).

As for problem solving, the situation for a company becomes worse when workers unfamiliar with the scientific method for problem solving begin to solve problems themselves and then arbitrarily decide when the problem is big enough to warrant a call for help (Spear S. and Bowen, H.K.,1999). Problems should not remain hidden. Proper attention should be given to them companywide and the root causes of them should be investigated. *Andon* lights help expose abnormal conditions in the factory, so corrective action can be taken (Suzaki, 1987).

For Ohno (1988), by asking *why* five times it is possible to uncover the root problem and correct it, instead of attending the more obvious symptoms. This is the scientific method to problem solving so ingrained at Toyota, as referred to by Spear S. and Bowen, H.K. (1999).

Multiskilling and Adaptability

According to Suzaki (1987), plants with multiskilled operators have much more responsive production systems to changing market demand than Taylorist companies with rigid job descriptions to strict areas of responsibility. Multiskilling implies flexibility, provides team members with an overall vision of the work to be done and facilitates learning and continuous improvement (Olivella, 2008).

Adaptability also is indispensable for lean production (Ohno, 1988). Workers should learn to be comfortable adapting to new situations. At Toyota an assembly line worker can perform any task at any place on the assembly line (Vaghefi et al., 2000).

Frequent task changes must be employed, even during the same day, to reinforce multiskilling (Monden, 1983). Job rotation challenges most operators to develop their skills. It gives operators an opportunity to vary their work patterns, which increases concentration and prevents the development of muscle and eye strain.

Common Values

Commitment is critical for new forms of work organization (Shapiro, 2001). Providing a positive atmosphere that fosters improvement is an important element for companies to grow. Managers should demonstrate visible commitment, while workers should be given information on the overall situation and prospects of the company, through company meetings and activities to inform workers on the different aspects of the company's business.

There are different methods to achieve commitment by all employees. Several studies have found differences between Japanese and Western styles of achieving commitment. In Japan, integration is facilitated through social relations among team members outside of work, whereas in Europe, these types of social relations are uncommon, and leadership is essential (Winfield, 1994). Alignment of individual goals and organizational goals in Toyota was studied by Besser (1995,1996) by observing a Toyota factory in the US. Engagement is obtained on behalf of the team: assignment of work and calculus of performance at team level link team members. Commitment to the company in Toyota is also obtained by the implicit obligation to offer workers lifetime employment.

Most Japanese companies have learned that it makes more sense to develop and utilize the workers' ability to improve performance and maintain job security rather than to rely on extra staff, management, and consultants, and risk alienating other workers (Suzaki, 1993).

Compensation and Rewards to Support Lean Production

It must be clear to workers that improvements are a normal part of the job. At the same time, leaders must feel that it is important to provide opportunities to encourage people for growth, through recognition and reward programs. The reward systems and structures should address this point well, in order to utilize people's resources effectively. Womack and Jones (1996) considered compensation systems fundamental to lean production.

For Suzuki (1987), the number of suggestions offered by employees is a good measure of the direct link between improvement and motivation. He goes on to question the following: "How can companies with dormant or inoperable suggestion programs compete with Toyota, whose employees generate millions of suggestions every year, with an adoption rate of over 90 percent?"

Some key features cited by Suzuki (1993) as being common to successful recognition and reward program are: simple to administer, not bureaucratic, quick to respond and evaluate, modest monetary reward, personal recognition, emphasis on fun and enjoyment, and top management's interest and commitment are present.

Rewards based on individual and team performance are also to be considered. Panizzolo (1998) found that performance-related pay systems are common in lean companies. Karlsson and Ahlstrom (1996a) described a remuneration system with a fixed part based on competencies and the responsibility taken on by the worker in the group, plus a bonus based on the team's productivity, quality and delivery.

As well as suggestions and performance, workers' skills should also be recognized, through rewards for the effort of learning more skills. An approach to encourage people to upgrade their skills is to have skill matrixes where every worker's skill levels are posted with skills they have mastered, date mastered and date of employment (Suzaki, 1993).

3. Results

The 4 plants visited during this work are subsidiaries of different multinationals from the automotive industry, and have from 500 to 1000 workers each. The interviews were conducted with top and middle management, and shop floor practices were observed directly. The key topics discussed on the interviews were standardization, discipline and control, training of new and existing workers, team and personal functions, organizational levels, improvement activities, display of information, recruitment, and compensation and promotion. The main information obtained is presented below. Each topic presented here could render extended discussions. However we will briefly analyze each one of practices and uncover possible topics for future research.

Standardization, Discipline and Control

All of the factories visited have successfully established standard operating procedures for all machine operations. As every worker performs each operation according to standards, performance does not vary from worker to worker, and job rotation becomes feasible without productivity variations (Ohno, 1988). Indeed all of these companies promote job rotation within production lines. Some promote it across different production lines (this is not present on all companies visited). However, different schemes of rotation are observed. For example, while one company might have a standard rotation schedule during each shift for all workers on the plant, another promotes rotation independently in each team, coordinated by team leaders, and yet another has it coordinated by the workers themselves on each team, only to be

monitored by team leaders. This later system is proven to work well at this particular company, promoting what they call a more relaxed environment in order for people to enjoy work.

Indeed, job-rotation usually varies in scheme from company to company. However it is reported as something useful in modern companies, which work on developing a multifunctional workforce to respond effectively to fluctuating demand.

Continuous Training and Learning

Some of the training programs observed in practice include training on continuous improvement, product information, quality, lean techniques, leadership, new technologies, new products, company values, languages, software, welding, etc. The internal programs on different issues are usually determined by current needs detected by audits. One company is currently promoting a worldwide training program on all its plants on company values, so it is considered important for every worker to share common values and company mission.

As for training of new workers, time periods observed varies between one and two weeks. For Ohno (1988), it should take only three days to train new workers on proper work procedures. Whether or not training could be faster at these companies is a topic to be investigated. Standardization plays a crucial role in training periods. The more operations are standardized, the quicker it is to teach and learn them.

Team leaders are responsible for training in some companies, while at others it is the responsibility of other assigned team members and technicians. So responsibility for training also varies..

Team-based Organizations

All plants visited work in teams. The teams observed were production line teams, being each line one team. These teams are lead by a team leader, under a supervisor, and supported by technicians. Some companies have one team leader for more than one line. Some have one team leader for each line with a supervisor for more than one line. Others have a team leader for each shift, and a supervisor for each line. The structure clearly varies from company to company, however all of them consider leadership essential for team performance. Functions of team leaders also vary. At one company they include promoting job rotation, support, organizing quality circles and suggestion systems, communicating monthly planning to workers, and evaluation of line workers. At others they also include training as discussed previously. Supervisors usually have the responsibility for safety, monitoring quality, productivity, cleanliness and organization (5S programs), and promoting teamwork. They may also monitor the level of multiskilling of workers to schedule training. Most of these companies delegate to line workers responsibility to guarantee quality, with visual aids, standards and measuring equipment, to reduce inspection before delivering to customers.

Team work is also present on quality circles, or kaizen events, as observed. They are organized by team leaders, and supported by technicians and supervisors, and their goal is to improve lines on any particular aspect, being it setup reductions, quality, safety, 5S, etc. Competitions between lines to see who has improved the most are seen to be effective at one particular company. Winner teams at this plant compete on corporate level competitions worldwide. This promotes healthy competition for improvements, which in turn enables the organization to better utilize its pool of talent. Recognition of such achievements is

considered for future promotions or raise in salaries. These activities are reported to further develop the sense of team work within the company.

One other company has structured and standard kaizen workshops. It applies them to particular lines that need improvement on specific aspects. The plant is mapped as to QVC (Quality, Volume or Cost) so the problems at each line are exposed. There is a kaizen workshop for each need, so specific workshops might be applied at a specific line for it to improve. The most utilized workshops work on lot size reduction, maintenance, standardization, set up reduction, kanban improvement, and lay out. At each one of these workshops, teamwork is reported to be strongly emphasized.

Participation and Empowerment

A recommended practice that was commented on all interviews, and in accordance to the literature, is to conduct periodic meetings with all employees in the plant. This promotes better communication between managers and operators, and informs every one of the current situation of the company through main indicators.

Worker empowerment varies from company to company. Some companies include first level maintenance as part of a team's responsibility, at the start of each shift, for instance. Others have a maintenance department totally responsible for maintenance. Whether or not more responsibility could be assigned to team leaders at these companies, as recommended, is an interesting topic for future research.

Team's and individual's responsibilities should be continuously broadened. To Suzuki (1993), employees should continuously try to eliminate their jobs or delegate them to subordinates or machines, so they have more time to explore more important responsibilities, improving the company's potential for growth.

At one particular company, each team member on each shift has his or her specific responsibility, being it safety, kanban, quality, or productivity. So, for example, the worker responsible for safety in the team checks every morning if there were safety related occurrences in previous shifts. He reports on safety issues in meetings. The person responsible for quality makes sure every one is concerned with quality. This way of breaking up responsibilities has proven to be an effective way to delegate more responsibility for line operators in this particular company.

Demand is strongly rising in recent years for this same company. Production goals are established by the line teams, along with supervisors, based on last year's production, aiming to raise productivity whenever possible. That drives people to improve their methods. Teams are audited every two months. So every line wishes to reach their goals to obtain an excellence certificate, and that represents a team's reward.

Multiskilling and Adaptability

While some companies visited have highly multiskilled labor, with rotation between positions in the same line and between different lines, one particular company has established a great number of short term contracts, such as two and three months, so temporary workers are a great part of the work force. This company prefers to hire workers for short periods for flexibility in responding to fluctuating demand. Whether or not this may be wasteful for this company is another topic for future research.

Quoting one interviewee: “Demands normally vary through time in the automotive industry, so lines have to be flexible to meet the demand. Flexibility is strongly needed.” Even though training may be costly at times, it is desirable for companies to promote multiskilling as much as possible, to have a flexible work force to attend to variations in demand.

As observed, visual display of workers skills is present at companies where multiskilling is valued. This promotes the incentive for workers to learn new skills, as it is visible for every one to see each worker’s accomplishments.

Supervisors are usually responsible for monitoring their section in terms of flexibility to respond to changes in demand. He or she monitors the level of multiskilling of line workers, so he or she knows when workers need to be reallocated or trained to meet production needs.

Common Values

Periodic meetings with all employees in the plant were observed on our visits. This was reported by one manager interviewed as being successful in promoting better communication between managers and operators, and informing every one on the current situation of the company through main indicators.

As also reported, one company is currently promoting a worldwide training program on all its plants on company values, so they consider it important for every worker to share common values and company mission.

By displaying information on workers performance regarding absenteeism, suggestions, performance, skills learned, etc., workers can monitor their progress. It was reported by a supervisor that this promotes motivation for better positions for line workers. By practicing display of information, and updating it, a company shares successes obtained by employees, motivating every one to learn and grow (Suzaki, 1993).

Compensation and Rewards to Support Lean Production

Various systems for promoting improvement were observed. For instance, a highly developed suggestion system, coordinated differently by team leaders at each cell, propels a great number of implemented suggestions on one particular company. Quality circles are also observed. They are organized by team leaders, and supported by technicians and supervisors, and their goal is to solve particular quality related problems. Competitions between lines to see who has improved the most are seen to be effective. Winner teams at this plant compete on corporate level competitions worldwide. This promotes healthy competition for improvements, which in turn enables the organization to better utilize its pool of talent. Recognition of such achievements is considered for future promotions or raise in salaries. These activities are reported to further develop the sense of team work within the company.

A point system where each worker earns or loses points according to absenteeism, suggestions, performance, etc was also proven to be successful at one particular company. Workers can monitor their progress. This promotes motivation for a better position for line workers.

Information is much more transparent in progressive companies than in the traditional companies (Suzaki, 1993). As observed, several information stations throughout one particular factory regarding quality and environmental issues, delivery, costs, social benefits, products information, etc. promote an environment where workers know exactly what is

going on in the plant and have sense of ownership. Along each cell, information boards containing information such as skill levels, production planned/executed, incidents, activities, 5S, rotation, self-maintenance information, standard procedures, safety procedures, etc are present at this company.

4. Conclusions and future research

Table 2 summarizes our perception to each practice being conducted at the plants we visited.

Table 2: Different levels of implementation for practices observed on each company

Practices	Companies			
	A	B	C	D
Standardization, discipline and control	●	•	•	●
Continuous training and learning	●	●	•	●
Team-based organization	●	●	●	●
Participation and empowerment	●	●	•	●
Multiskilling and adaptability	•	•	●	●
Common values	●	●	●	•
Compensation and rewards to support LP	●	•	○	•

(○) very little practiced; (•) somewhat practiced; (●) emphatically practiced

As we commented before, each one of these practices could be investigated and discussed more thoroughly. However we have briefly analyzed them, and through examples, we have observed that different degrees of implementation are present on each one of these companies practicing lean principles. We have uncovered some possible topics for future research, as we observed that some companies do not practice, on the expected level, some of the policies recommended by main authors on the subject. One possible topic is multiskilling (some companies hire extra staff to meet demand, instead of utilizing its work force, and this might be wasteful, as they might not be utilizing their workforce's full potential). Another is on the delegation of responsibilities (some functions such as machine maintenance are not part of line workers responsibilities, and this could be wasteful for the company, by having supervisors and technicians spending valuable time on it instead of addressing more important issues).

As companies adopt these well reported and recommended practices, tailoring them to their particular cultures and labor laws, we believe that productivity and work environment conditions could be perfected, maintaining or acquiring competitiveness in the global market.

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